Machine Guarding

Image credit: OSHA

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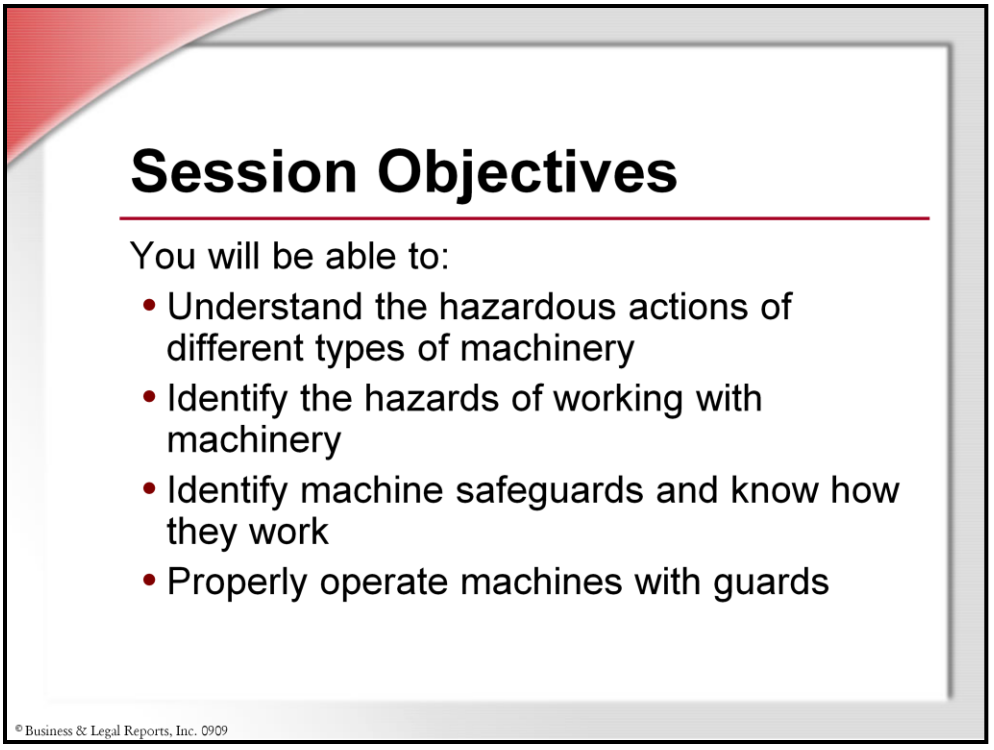
Slide Show Notes

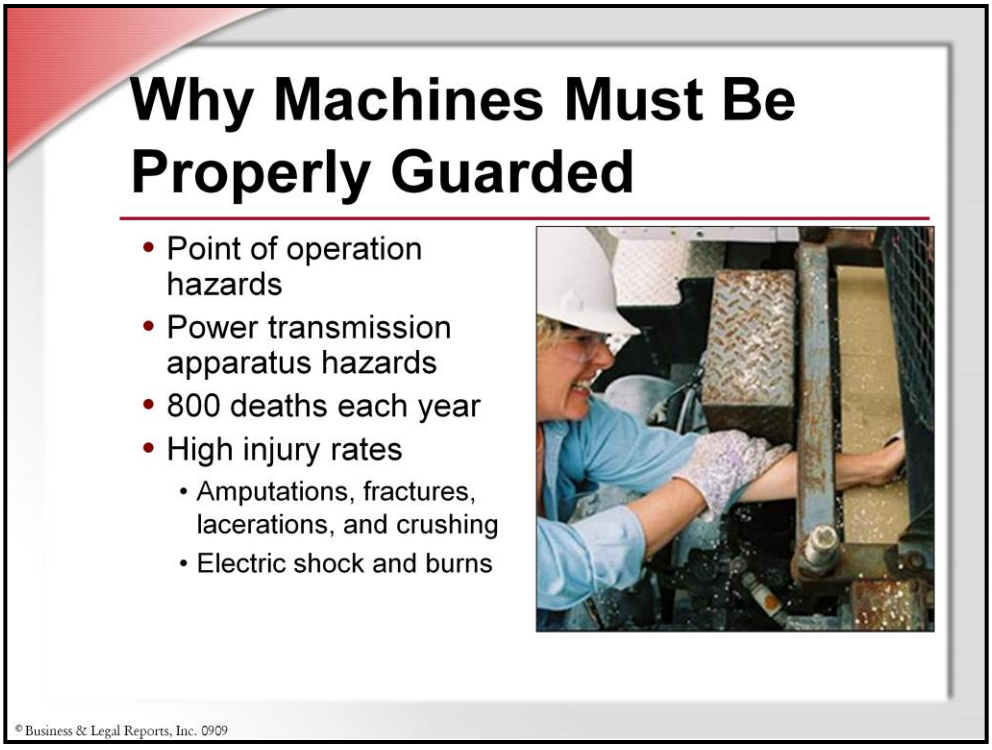
- Welcome to this training session on Machine Guarding. This session includes important information about how to protect yourself against serious injury when working with powerful machines.



Slide Show Notes

By the end of this training session, you will be able to:

- Understand the hazardous actions of different types of machinery that could cause you serious injury;
- Identify the different hazards of working with machinery;
- Identify machine safeguards and know how they work; *and*
- Properly operate machines that have guards.

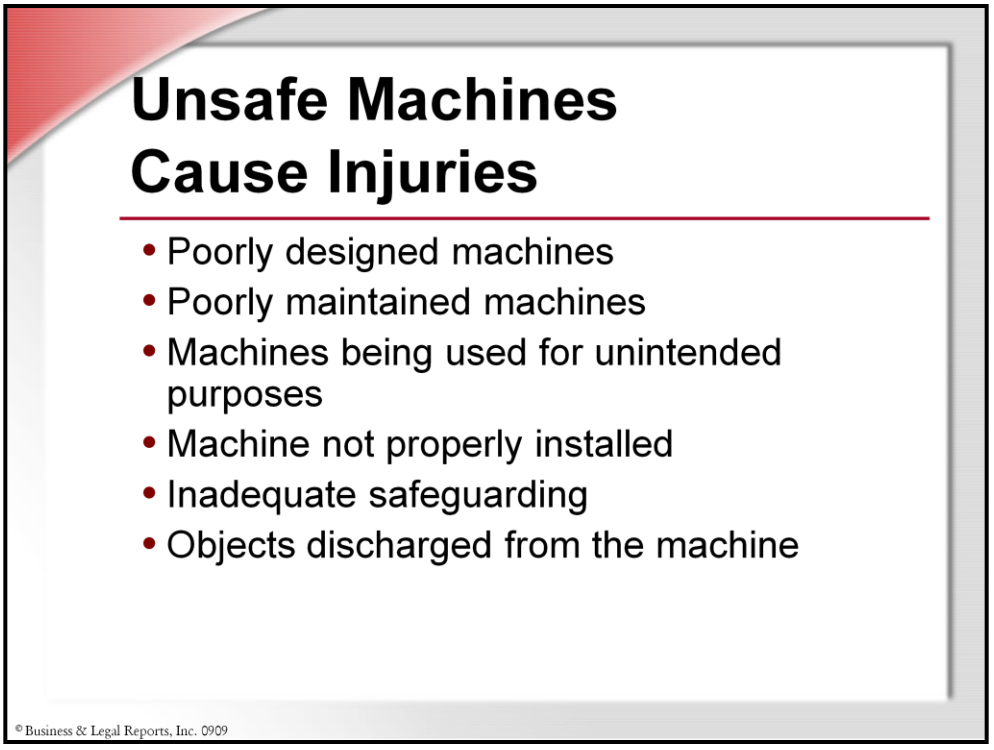


Slide Show Notes

Why is it important for machines to be properly guarded? Here are the main reasons:

- Point of operation hazards cause thousands of injuries every year. The "point of operation" is where the machine part contacts the material that is being worked on. Examples include a cutting blade or a drill bit.
- Power transmission apparatus hazards also cause many serious injuries. The power transmission apparatus includes moving parts, such as wheels and gears, that transfer power to the point of operation.
- According to the Occupational Safety and Health Administration, or OSHA, more than 800 deaths occur per year to workers who operate and maintain machinery.
- Rates of injury are also high for employees working with machines. Federal statistics show that 92,000 injuries per year occur to workers in the United States from unguarded machine parts, which result in one or more lost work days.
  - Examples of these injuries include amputations, fractures, lacerations, and crushing of body parts. There are approximately 18,000 such injuries every year, and they often cause long-term or permanent disability.
  - Other types of machine-related injury include electrocution and burns from unprotected machine parts.

You can probably think of many kinds of injuries that machines in your workplace might cause if people don't pay attention to safety. Can you think of some examples of machine-related injuries that have occurred or potential injuries that can occur in your work area?

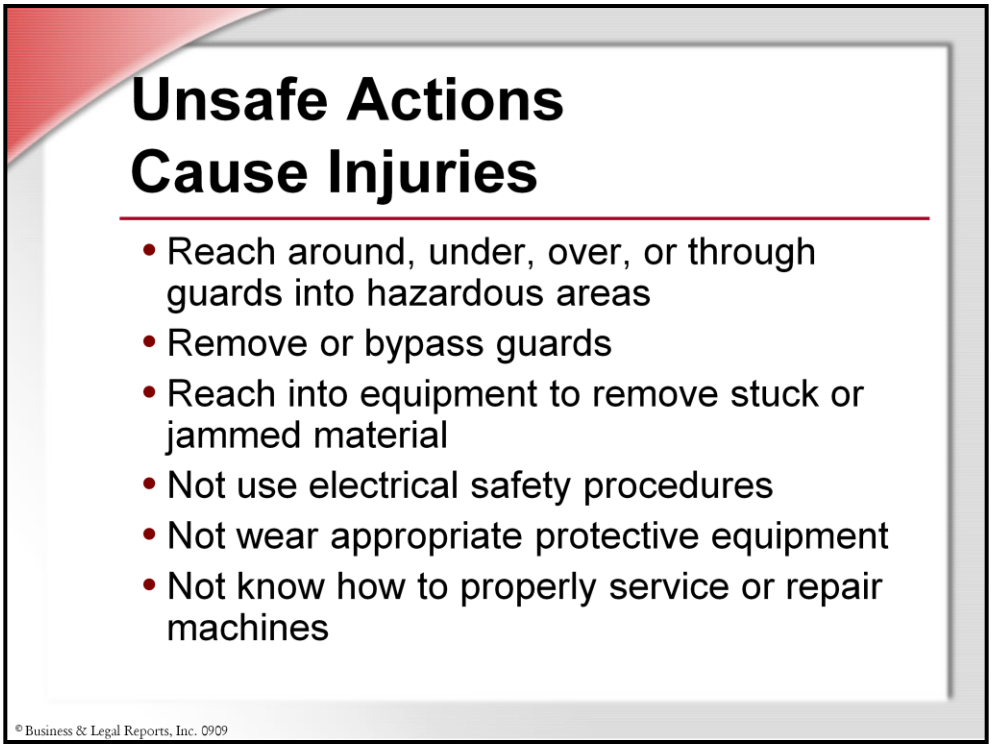


Slide Show Notes

Unsafe machines cause many injuries. Examples of unsafe machines include:

- Machines that are poorly designed; these are inherently more likely to cause injuries than machines with a safer design;
- Machines that are poorly maintained; these cause injuries because they don't function properly;
- Machines that are not being used for their intended purposes;
- Machines that are not properly installed;
- Inadequate safeguarding of machines; *and*
- Objects being discharged or expelled from a machine.

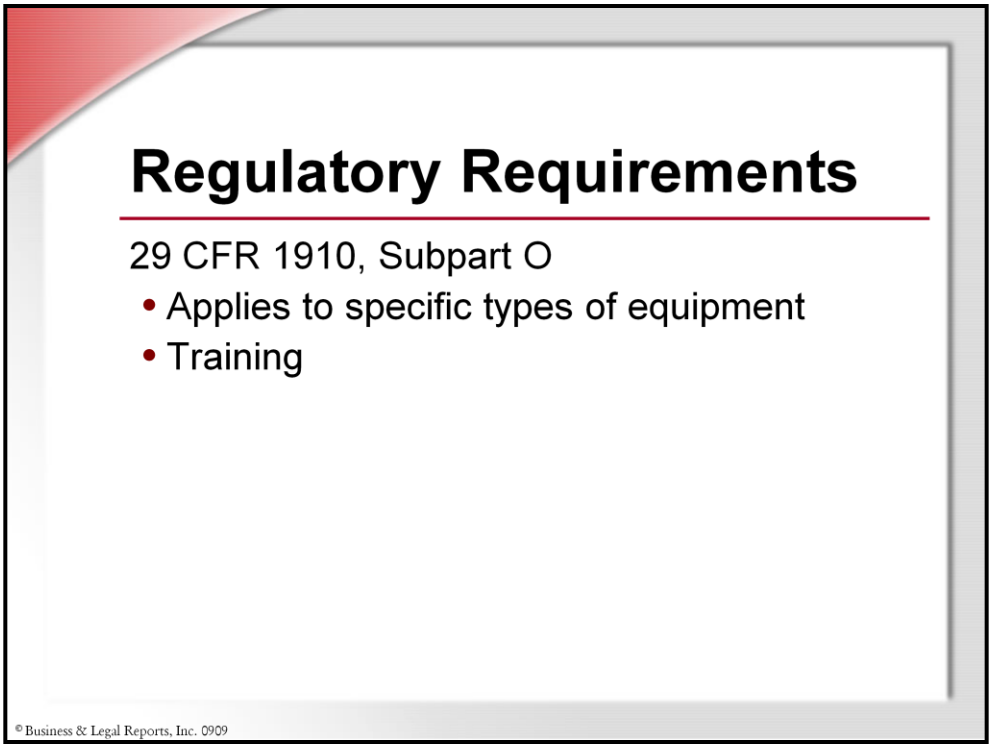
What might be some specific potential causes of injuries at your department's workplace?



Slide Show Notes

Unsafe actions around machines—or failure to take proper actions—are also a major cause of injury. Examples of unsafe actions include:

- Reaching around, under, over, or through machine guards into hazardous areas;
- Removing or bypassing machine guards;
- Reaching into moving equipment in order to remove stuck or jammed material;
- Not using electrical safety procedures, including lockout/tagout;
- Not wearing the right personal protective equipment; *and*
- Not knowing how to properly service or repair machines.



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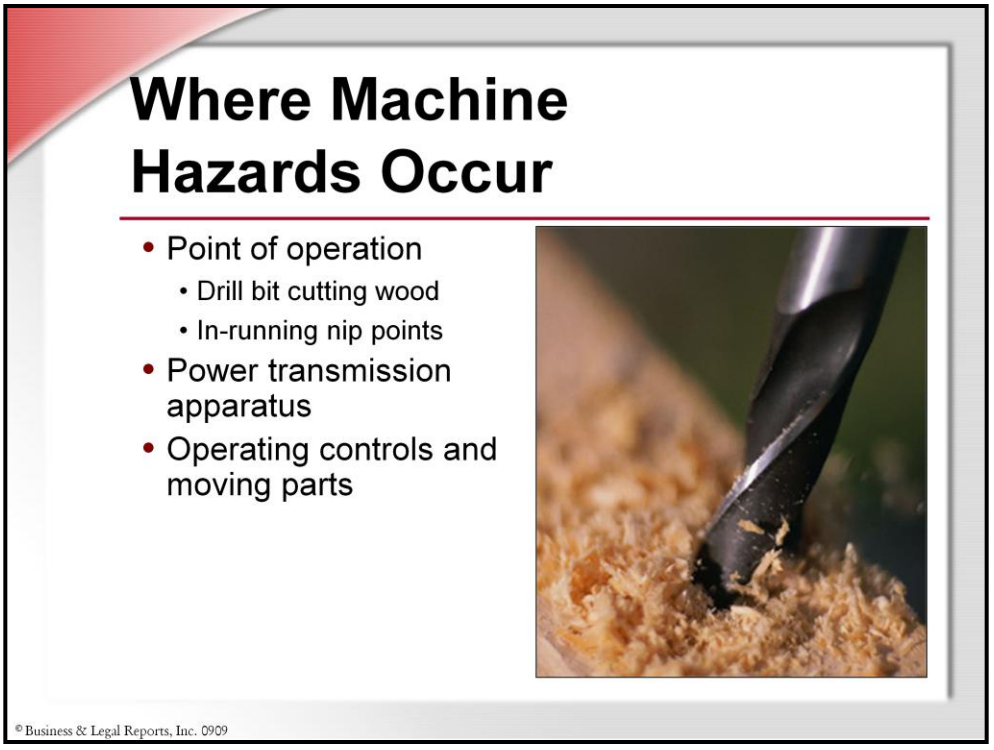
OSHA has a number of regulatory requirements that apply to machines and machine guarding. These are found in the Code of Regulations Title 29, Section 1910, Subpart O.

- These rules apply to specific types of equipment, including power presses, woodworking equipment, and forges. The most important thing to remember is that if a machine has certain movements or actions that could affect you when you operate it, then it must be guarded in some way.
- The rules also require training in the proper and safe operation and maintenance of machines for those who operate or service them.



Slide Show Notes

Machine hazards occur most commonly in one of three areas of a machine or operating equipment with moving parts:

- The *point of operation* is where the work is actually performed on the material. Examples include:
  - A drill bit cutting into wood or metal; *or*
  - In-running nip points—that is, points where machine parts move toward each other, or points where a moving part moves past a stationary object.
- The *power transmission apparatus* includes the parts of a machine that transfer energy to the parts that perform the work. Examples include flywheel, pulleys, belts, chains, connecting rods, couplings, cams, spindles, cranks, and gears.
- *Operating controls* and other moving parts include all the other parts of a machine that move while the machine is in operation.

Types of Rotating Machine Parts

- Collars, couplings, and cams
- Clutches, gears, and pulleys
- Flywheels
- Shafts, including shaft ends

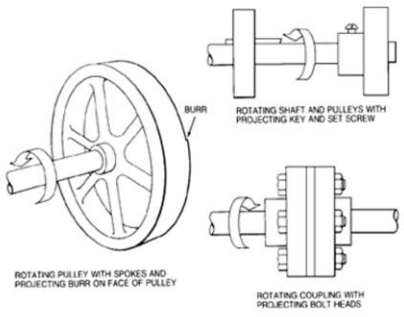


Image credit: OSHA

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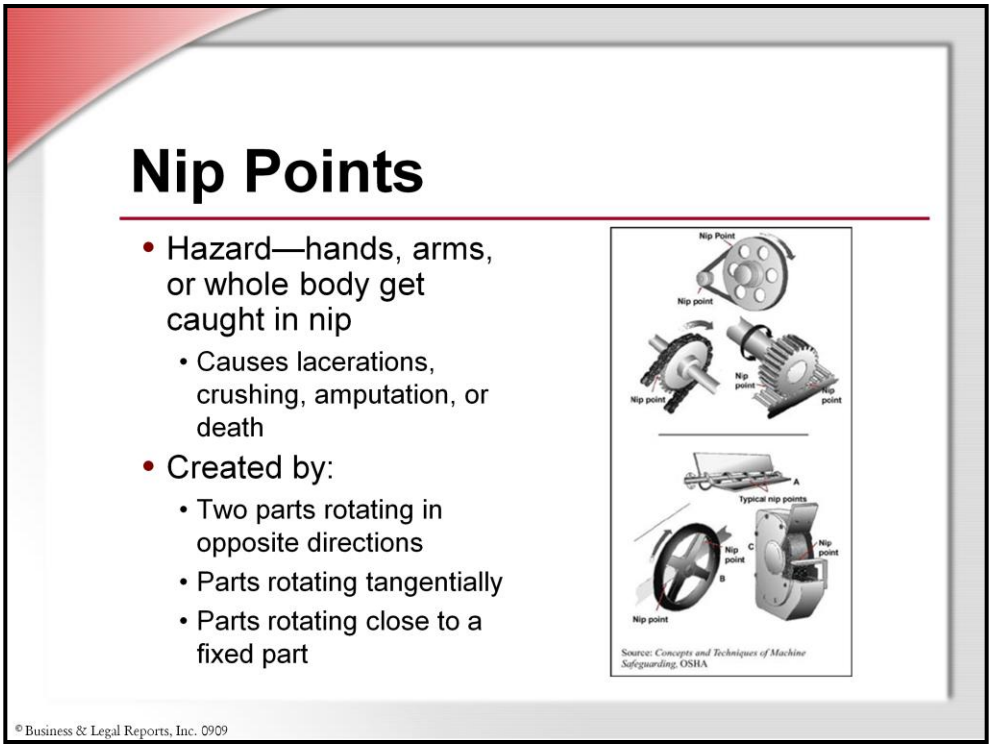
Rotating parts and shafts can catch your hair or clothing and seriously injure you. They can also force your hand or arm into a dangerous position, breaking bones and lacerating or even causing amputation. If a moving part has bolts, screws, or other projections, the danger is even greater. You could be struck by a projecting bolt or key.

Common types of rotating mechanisms include:

- Collars, couplings, and cams;
- Clutches, gears, and pulleys;
- Flywheels; *and*
- Shafts, including the ends of shafts.

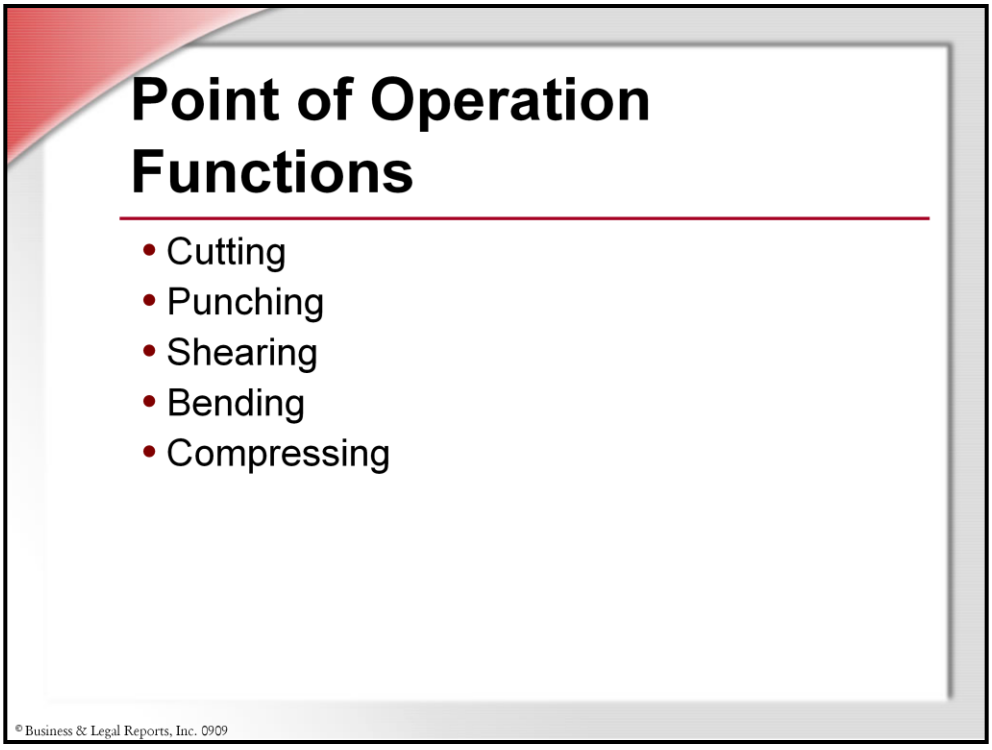


Slide Show Notes

Nip points of typical machines are shown on this slide. Take a moment to identify the nip points; as you can see, they can be difficult to guard.

- Nip point hazards include having your hands, arms, or whole body caught in the nip, causing lacerations, crushing, amputation, or even death.
- Nip points are created by:
  - Two or more parts rotating in opposite directions;
  - Parts rotating tangentially to each other; *or*
  - Parts rotating close to a fixed part.

Do you know the nip points on machinery in your workplace?

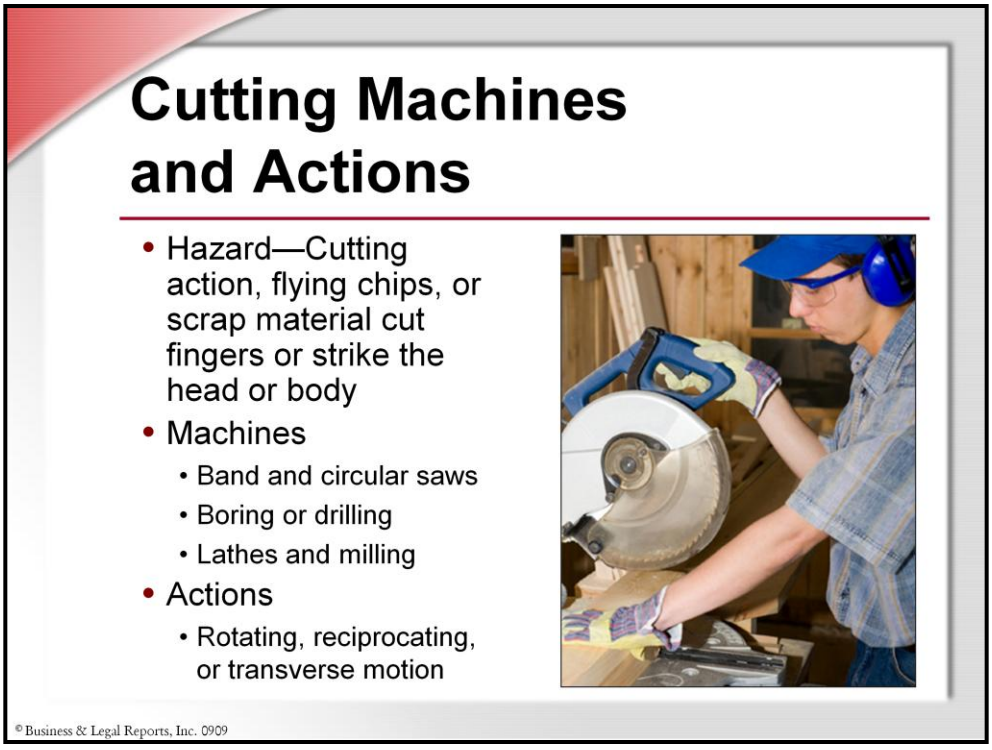


Slide Show Notes

Here are some of the common functions of the points of operation of machines. They include:

- Cutting wood, metal, or other materials;
- Punching wood, metal, or plastic;
- Shearing;
- Bending; *and*
- Compressing.

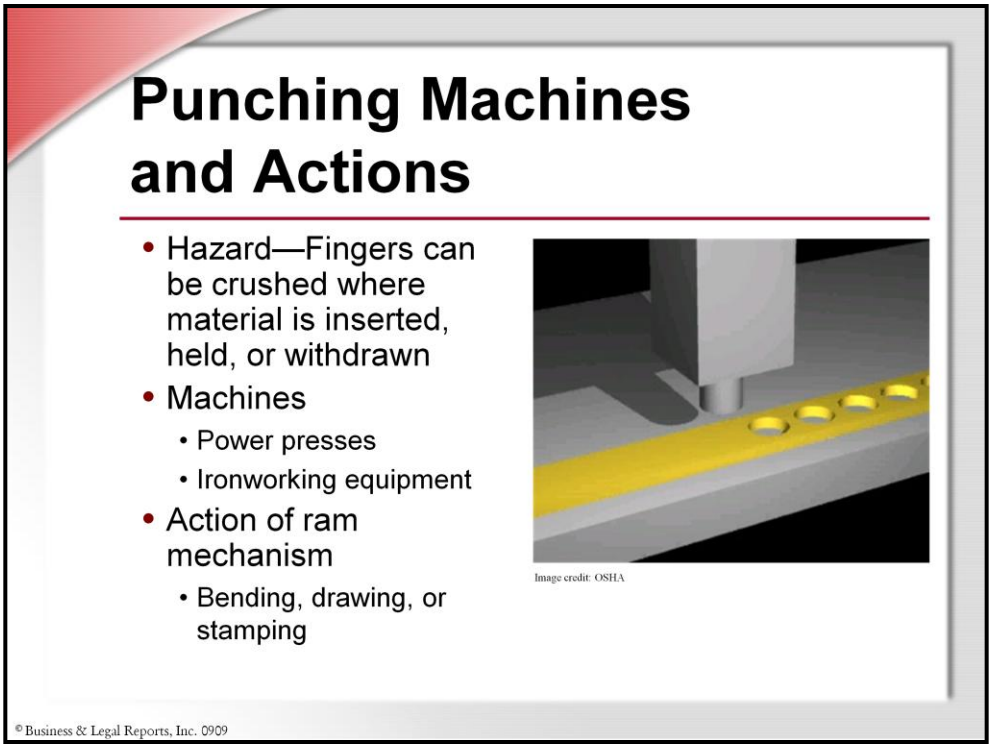
The point of operation generally presents the highest hazard to a machine operator. The further the machine operator is from the point of operation, the lower the hazard.



Slide Show Notes

Cutting machines are common in various industries, and it's easy to forget how hazardous the actions of these machines can be.

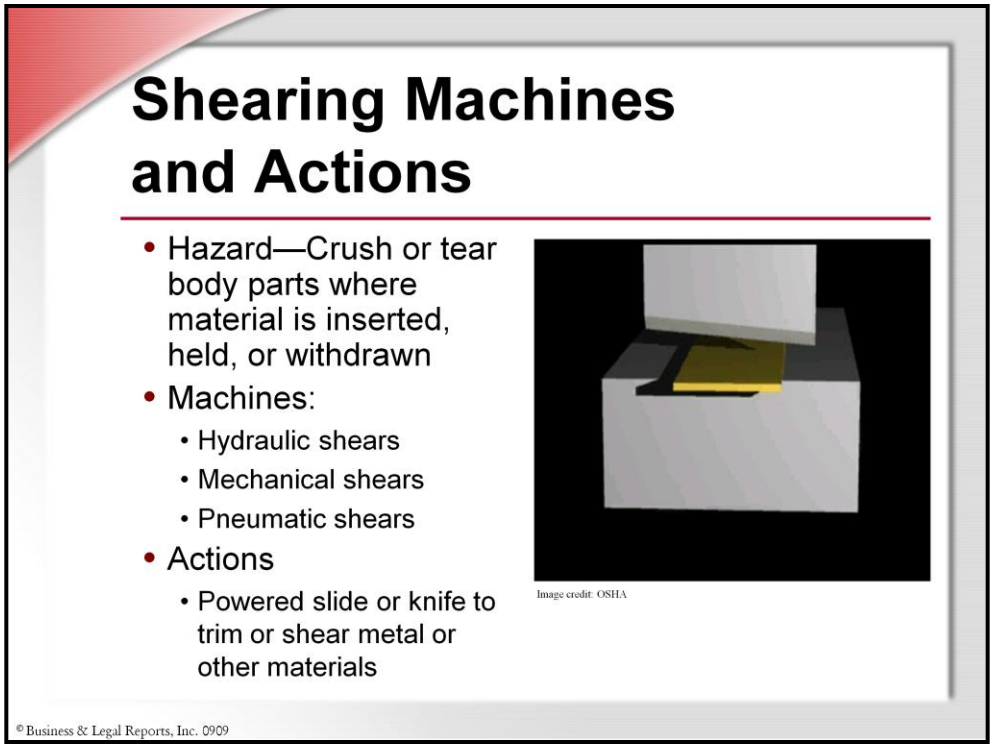
- Cutting hazards occur when your fingers, hands, and other body parts are exposed to cutting actions, or when flying chips or scrap material can strike your head, face, or eyes.
- Examples of cutting machines include band and circular saws, boring or drilling machines, and lathes and milling machines.
- Cutting actions include rotating, reciprocating, or transverse motions.



Slide Show Notes

Punching machines involve actions that carry a tremendous amount of force. Therefore, it's extremely important to guard the point of operation of these machines and keep body parts out of harm's way.

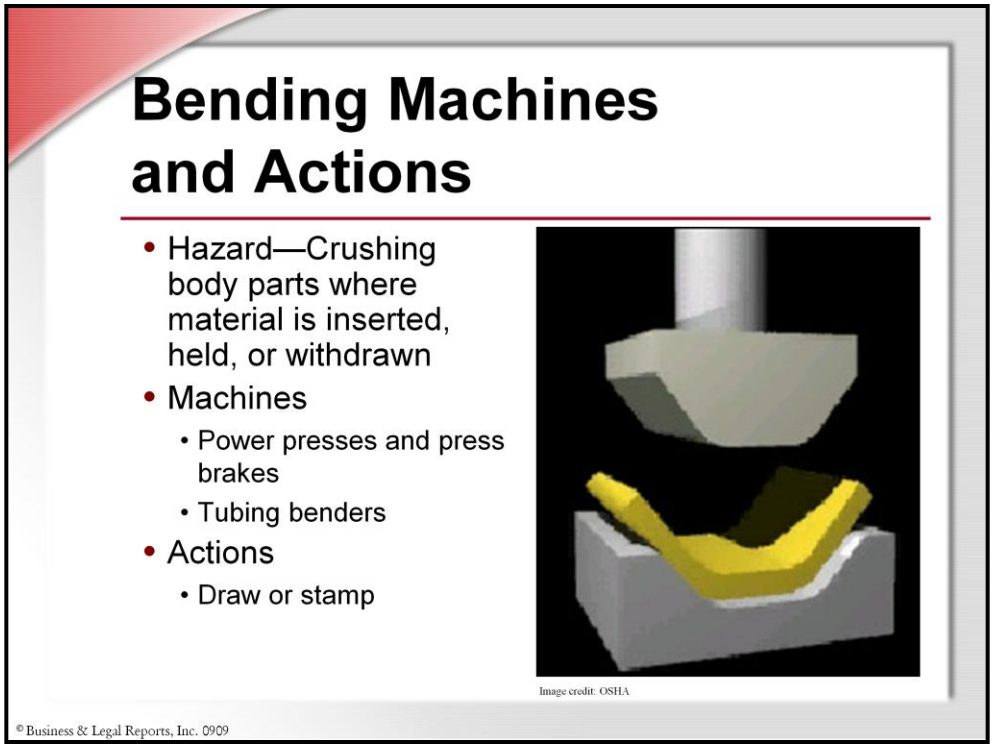
- Punching hazards occur when your fingers or hands could be crushed while inserting, holding, or withdrawing material by hand.
- Examples of punching machines include power presses and ironworking equipment.
- Ram mechanisms are another example of hazardous action that is used on metal or other materials for the purpose of bending, drawing, or stamping.



Slide Show Notes

Shearing machines obviously can be highly dangerous.

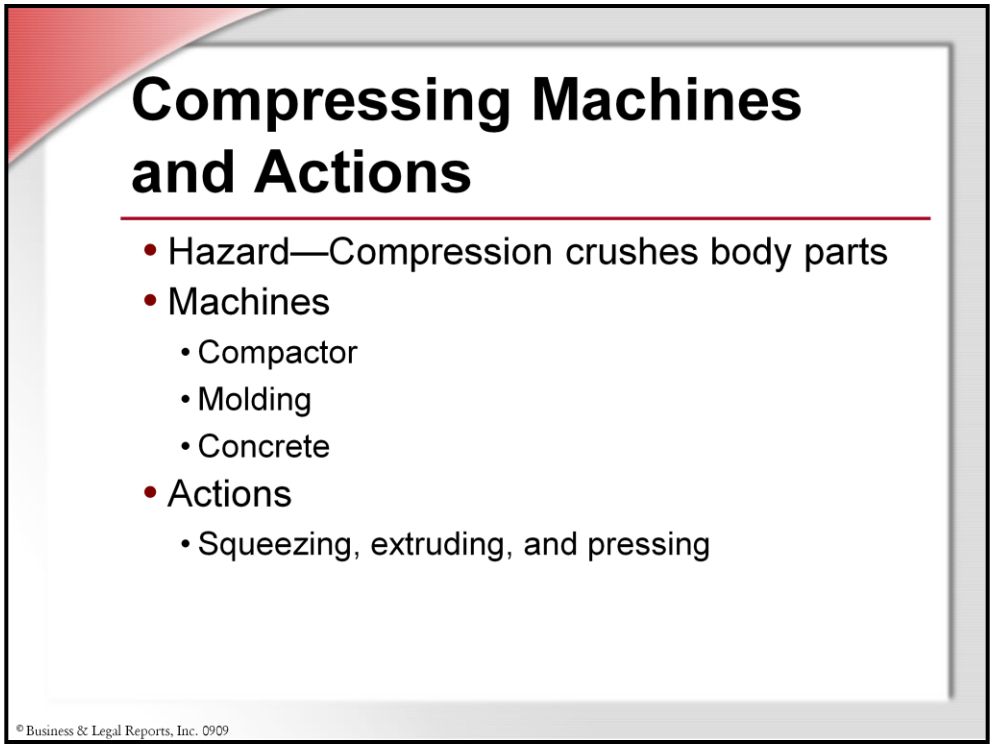
- Shearing hazards include the crushing or tearing of body parts at the point where material is inserted, held, or withdrawn.
- Shearing machines can be powered by hydraulic, mechanical, or pneumatic energy.
- Shearing actions include the use of a powered slide or knife to trim or shear metal or other materials.



Slide Show Notes

Bending machines also use a tremendous amount of force to do their work and, therefore, present a major hazard to operators.

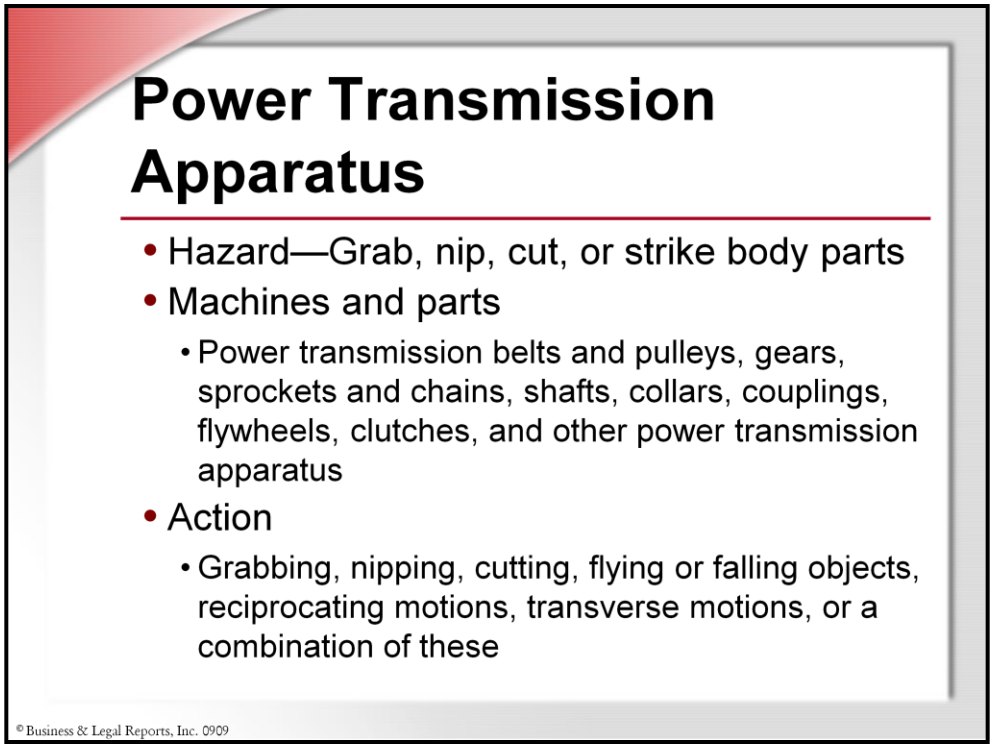
- The main hazard is the potential for crushing body parts where material is inserted, held, or withdrawn.
- Examples of bending machines include power presses and press brakes, and tubing benders.
- Bending actions are those that apply power in order to draw or stamp metals or other materials.



Slide Show Notes

Compressing machines are a final example of hazardous machines that use a great deal of force.

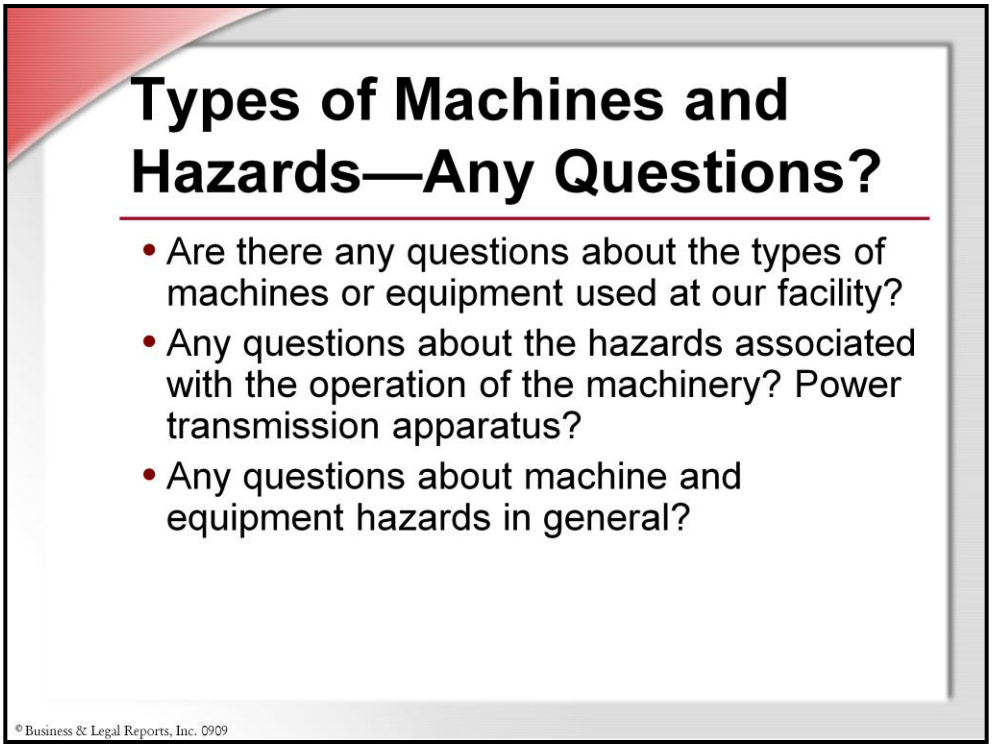
- Compressing actions can crush or amputate body parts.
- Examples of compressing machines include compactors, molding machines (including injection molding), and machines that compress concrete.
- Compression actions that are hazardous include squeezing, extruding, and pressing.



Slide Show Notes

The power transmission apparatuses of a machine are the mechanical components that act in conjunction with a source of power—often called the "prime mover"—to provide the motion to a machine part. The power from the prime mover is transferred through the transmission apparatus to the various machines in the workplace. The power from the prime mover can come from mechanical, electrical, steam, pneumatic, or hydraulic sources.

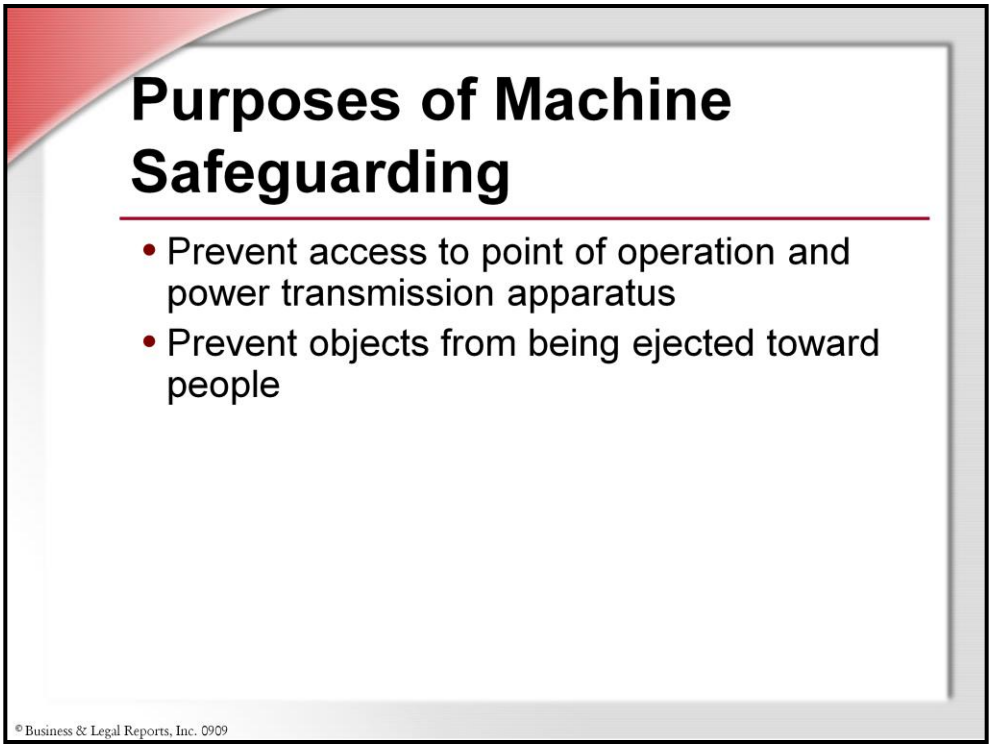
- The hazards of power transmission apparatus include grabbing, nipping, cutting, or striking body parts or clothing.
- Power transmission apparatus parts can include belts and pulleys, gears, sprockets and chains, shafts, collars, couplings, flywheels, and clutches.
- Hazardous actions of power transmission apparatus include grabbing, nipping, cutting, causing flying or falling objects, reciprocating motions, transverse motions, or a combination of these actions.



Slide Show Notes

Do you have any questions about the various types of machines and their hazards?

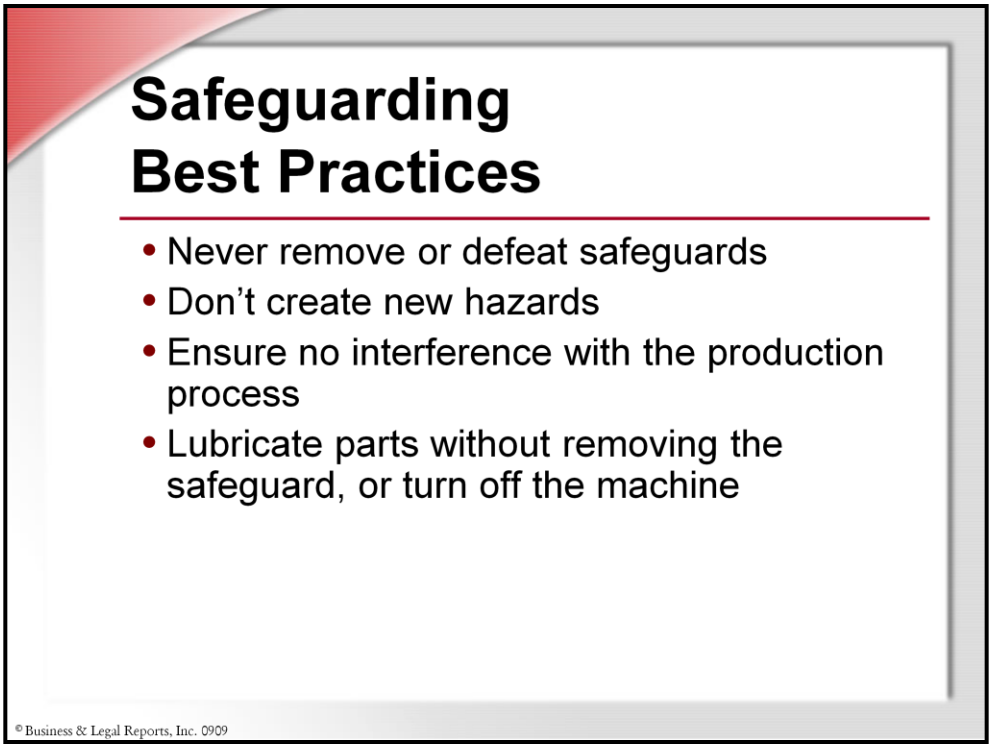
- Do you know about the types of machines used in your workplace?
- Do you have any questions about the hazards of the point of operation of machines or the power transmission apparatus?
- Do you have any questions about machine and equipment hazards in general?



Slide Show Notes

The next slides will describe various kinds of safeguards designed to protect you from machine injuries. But first, it's important to understand the fundamental purposes of machine safeguarding:

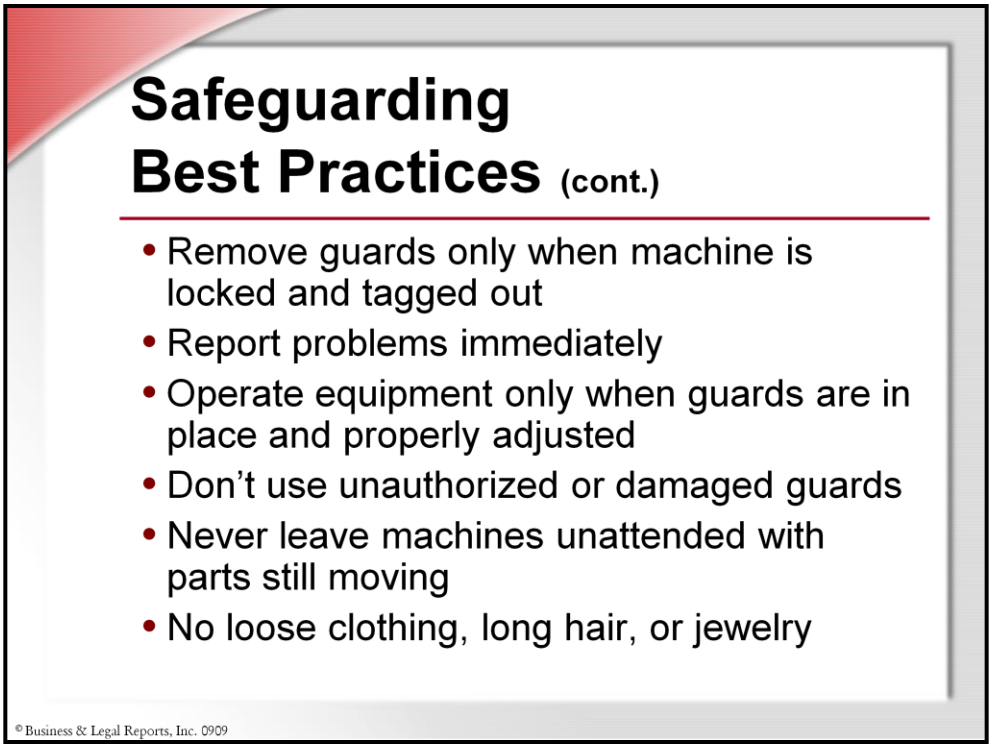
- Safeguarding prevents access to the point of operation and power transmission apparatus of a machine; *and*
- Safeguarding prevents objects from being ejected from the machine toward you and other people.



Slide Show Notes

Here are some of the fundamental safety rules, or "best practices," to follow when it comes to machines and their safeguards:

- Never remove or try to defeat machine safeguards.
- Don't create new hazards, such as by allowing objects to fall into the moving parts or by creating a new pinch point.
- Ensure that machine safeguards do not interfere with the typical production process. If they do, then there will always be a temptation to remove or bypass these safeguards. Instead, it's better to review the design of the safeguard and find ways to make it more effective without interfering with the work.
- If possible, lubricate machine parts without removing the safeguard; otherwise, turn the machine off before lubricating.

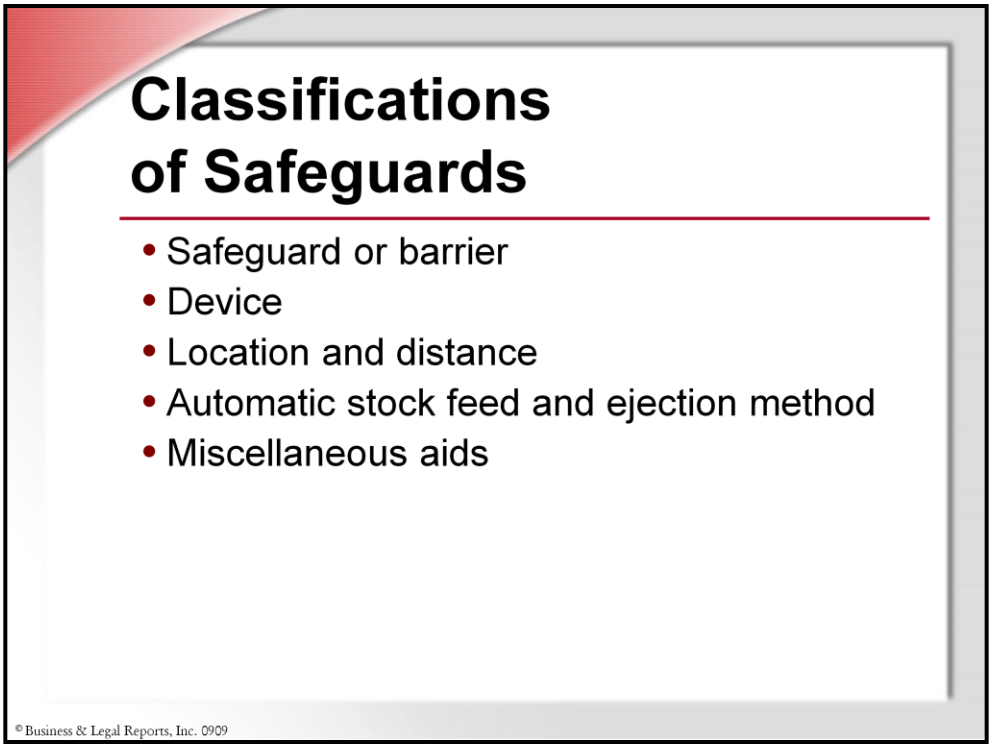


Slide Show Notes

Additional best practices for machine safeguards are:

- Remove guards only when the machine has been locked out and tagged out.
- Report any problems with machine guards to your supervisor immediately.
- Operate equipment only when guards are in place and properly adjusted.
- Do not use unauthorized or damaged guards.
- Never leave machines unattended with parts still moving. Remember that parts may still be moving after the machine has been turned off.
- Finally, do not wear loose clothing, jewelry, or long hair around machines—these increase the risk of being caught in the machinery.

Do you have any additional safe work practices employed in your department?

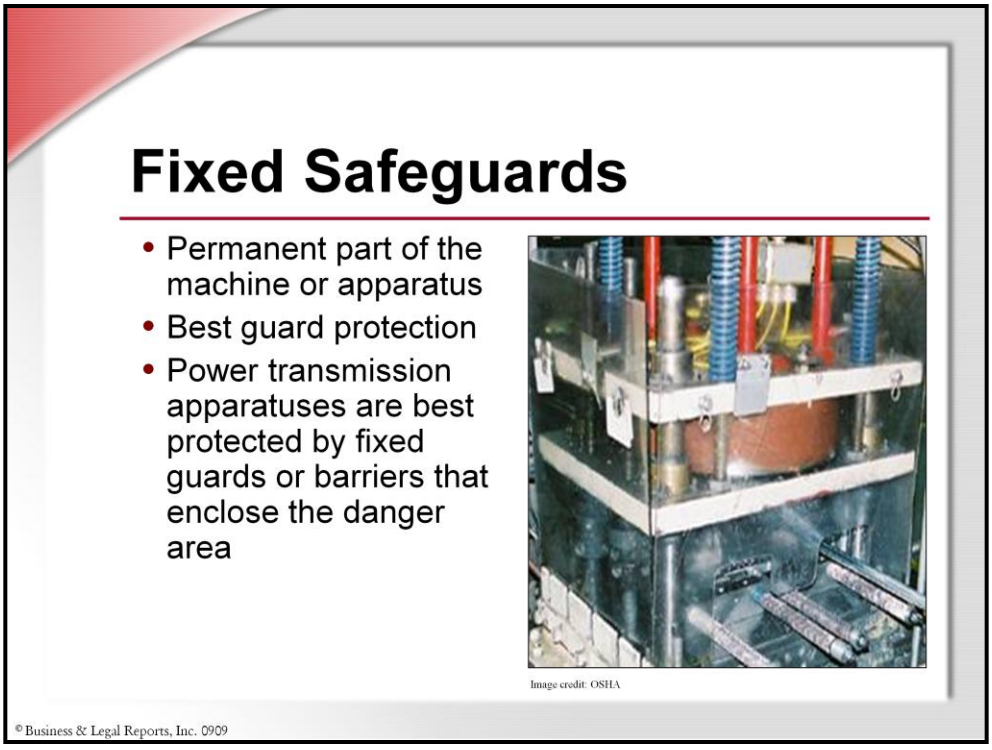


Slide Show Notes

There are five different basic classifications of machine safeguards:

- A safeguard or barrier that prevents you from reaching the moving parts.
- A device—such as a presence-sensing device—that stops the motion of the machine or apparatus before you can come into contact with it and that prevents restarting until an operator manually resets it.
- Location and distance are ways to physically isolate the machine or moving parts from people. For example, the machine may be placed in a locked room, or the power transmission apparatus may be located more than 7 feet from the work surface.
- Automatic or semiautomatic stock feeding and ejection methods reduce the need for operators to endanger their fingers and hands.
- Finally, there are miscellaneous aids, such as push sticks or other tools, for placing or removing materials, rather than using your hands.

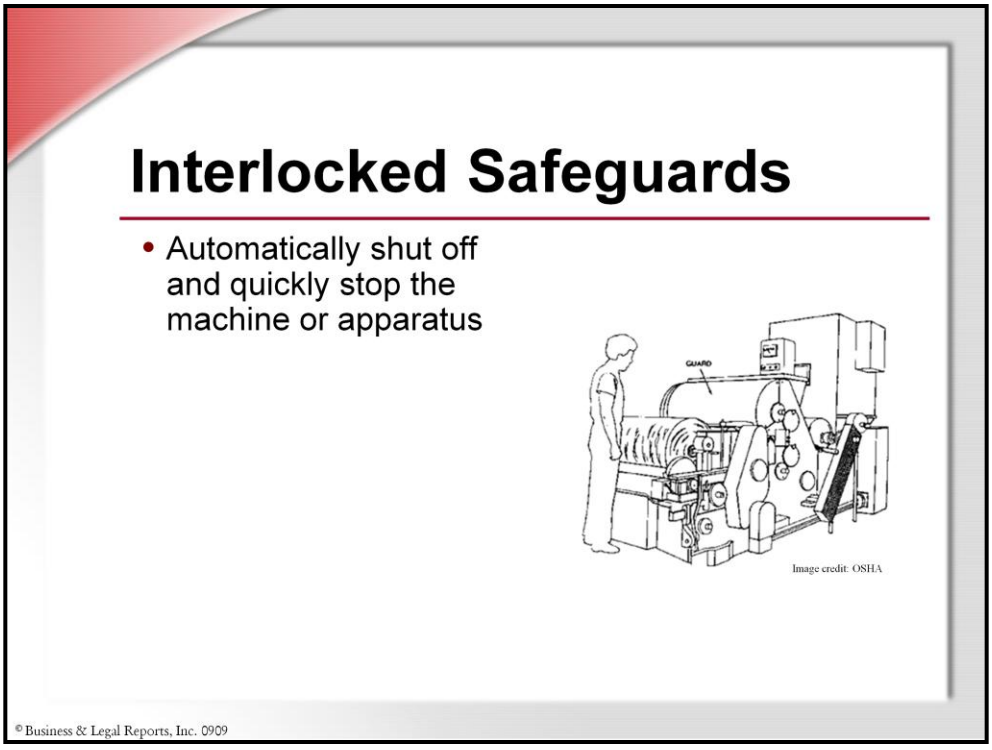
Now we'll describe these types of devices in greater detail.



Slide Show Notes

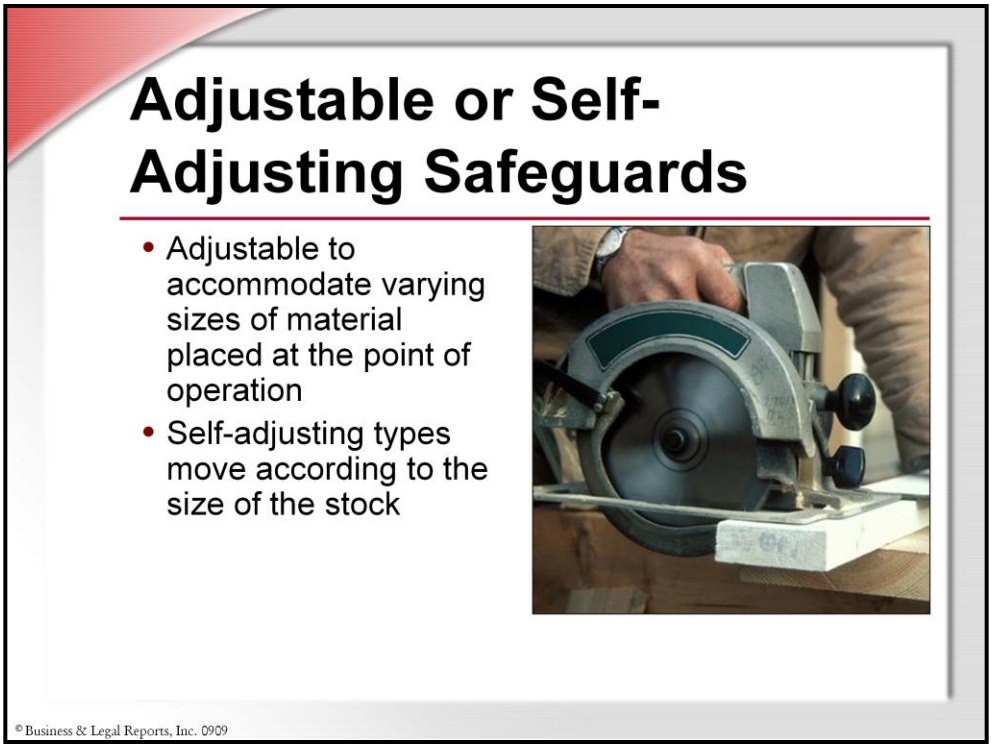
Fixed safeguards, or barriers, are a commonly used way to protect against injury.

- Fixed guards are a permanent part of the machine or apparatus.
- Generally, they provide the best kind of protection against injury.
- As a general rule, power transmission apparatuses are best protected by fixed guards that completely enclose the danger area.



Slide Show Notes

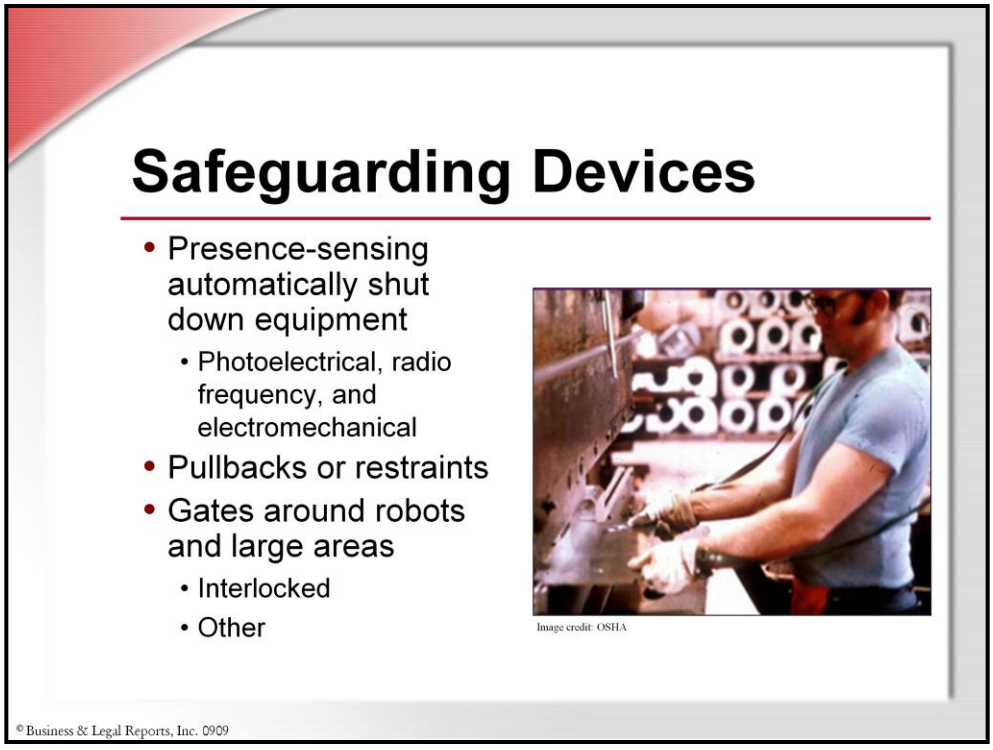
Interlocked safeguards are guards that automatically shut off and quickly stop the machine when the guards are opened. Never try to defeat or bypass an interlocking safeguard.



Slide Show Notes

Adjustable or self-adjusting safeguards are present on many kinds of machines.

- Adjustable guards can accommodate varying sizes of material placed at the point of operation; they need to be adjusted manually.
- Self-adjusting safeguards provide a barrier that moves according to the size of the stock moving into the point of operation.



Slide Show Notes

Safeguarding devices provide the same amount of protection as guards. There are several kinds of safeguarding devices, including:

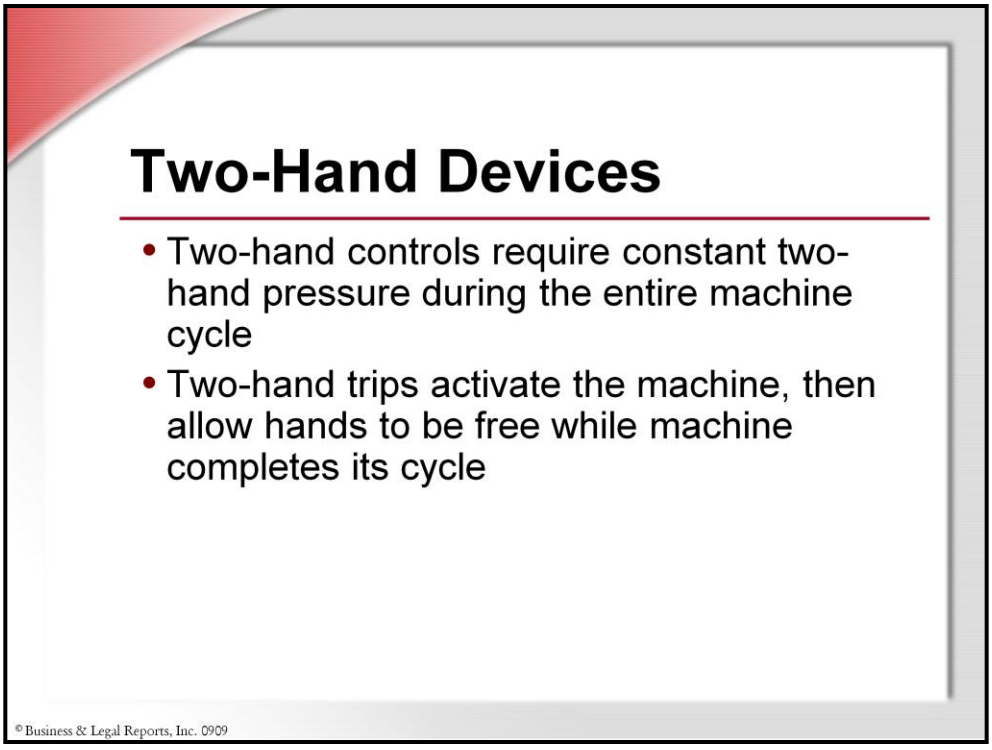
- Presence-sensing devices that automatically shut down equipment when you get too close to moving parts. Photoelectrical devices use light to detect the presence of an operator; there are also radio frequency and electromechanical devices.
- Pullbacks and restraints are not as common as they were in the past, but there may be older equipment that use them. The photo on this slide shows a worker with a restraint device.
- Gates are often found around robots and other operations that require a fairly large area and, therefore, require guarding around the perimeter. Gates can be used across openings in a piece of equipment. Perimeter gates around equipment should be interlocked.

What other examples of safety devices that may be used in your department?

Slide Show Notes

Other types of safeguarding devices include:

- Safety trip controls that typically rely on the force of the operator leaning against them. This trips a microswitch that shuts down the equipment. Examples include:
  - A pressure-sensitive body bar;
  - A safety tripod; *and*
  - A tripwire cable such as the one shown in the photo, which is placed around the danger area and can be reached immediately by the operator.
- Two-handed control devices reduce hazards by eliminating the possibility of freeing up one hand while operating the equipment with the other. Note that it is against the rules for any operator to try to defeat a two-hand control by using what is known as a "cheater bar."



Slide Show Notes

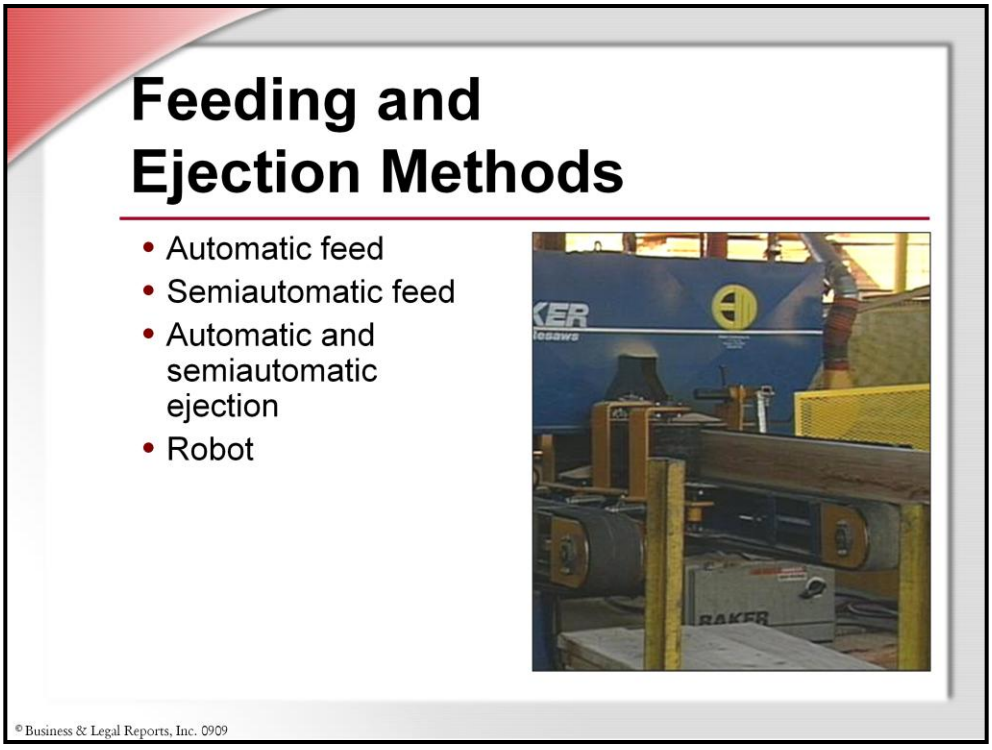
Two-hand devices are an effective way to avoid serious hand injuries.

- Two-hand controls require the constant pressure of both hands during the entire machine cycle.
- Two-hand trips activate the machine, then allow the hands to be free while the machine completes the cycle. Two-hand trips need to be placed far enough away from the hazard that the operator cannot reach the hazard.

Slide Show Notes

Using location and distance as safeguards against machine accidents can be highly effective.

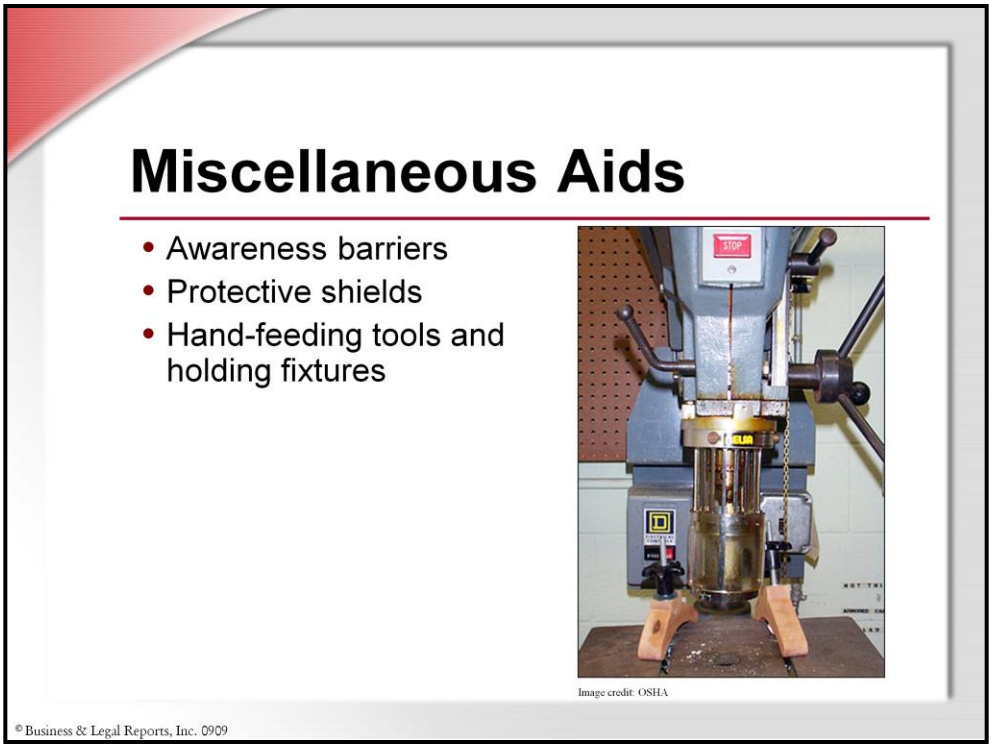
- This method separates operators from the equipment, and virtually eliminates the risk of injury.
- The separation makes it very unlikely that a body part can contact a moving part.
- While this method is very effective, it may be limited by the amount of workspace available in the work area.



Slide Show Notes

There are a number of feeding and ejection methods that reduce the risk of serious injuries.

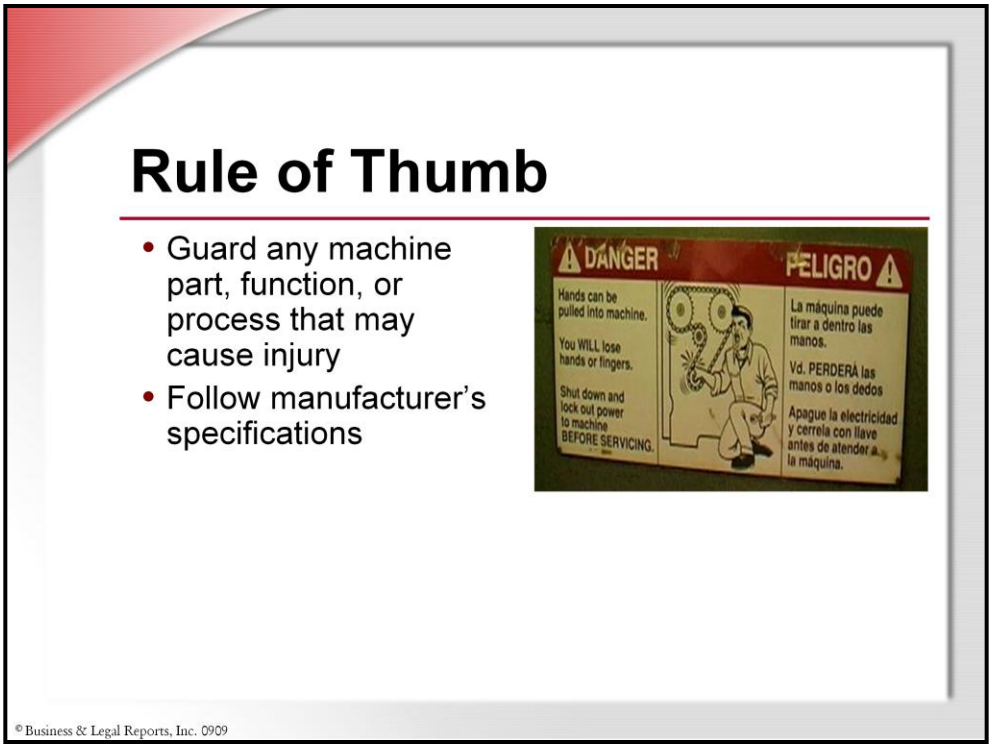
- Automatic feeding does not require you to place your hands in the danger area at all; sometimes, there is no operator involvement after the machine is set up.
- With semiautomatic feeds, operators can manually feed the stock with the assistance of a feeding mechanism.
- Automatic and semiautomatic ejection methods require little or no operator involvement after the machine starts to function.
- A robot is an effective example of automatic feeding and ejection.



Slide Show Notes

There are several miscellaneous aids that help protect against machine hazards, although they usually do not provide complete protection. They do provide an extra margin of safety if used properly. Examples include:

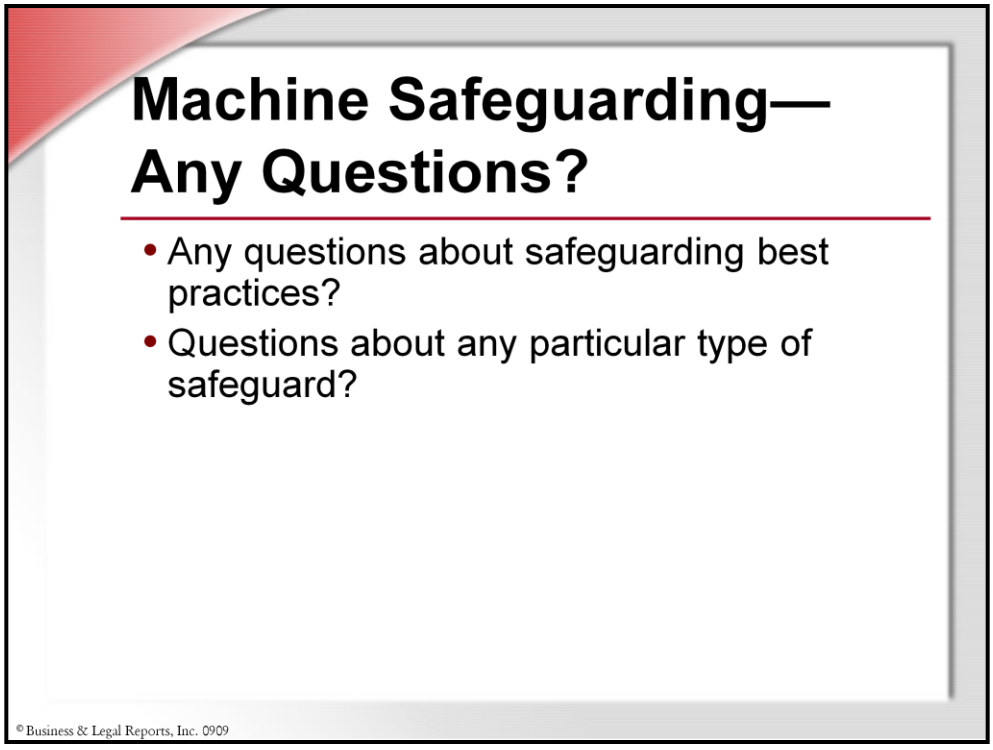
- Awareness barriers;
- Protective shields, such as the one shown here around a drill press; *and*
- Hand-feeding tools and holding fixtures, such as hand-held clamps used to insert or remove material from the point of operation.



Slide Show Notes

Here are two good "rules of thumb" when it comes to safeguarding machines:

- There must be a guard on any machine part or function that could cause an injury if contacted by an operator. OSHA's rules for machines are performance-oriented, meaning that companies may design their own safeguards as long as they work effectively.
- Most modern machines include guards that are designed and installed by the manufacturer. You should always read and follow all manufacturer's specifications for the use of machine guards, unless another safe procedure or process has been implemented by your company.



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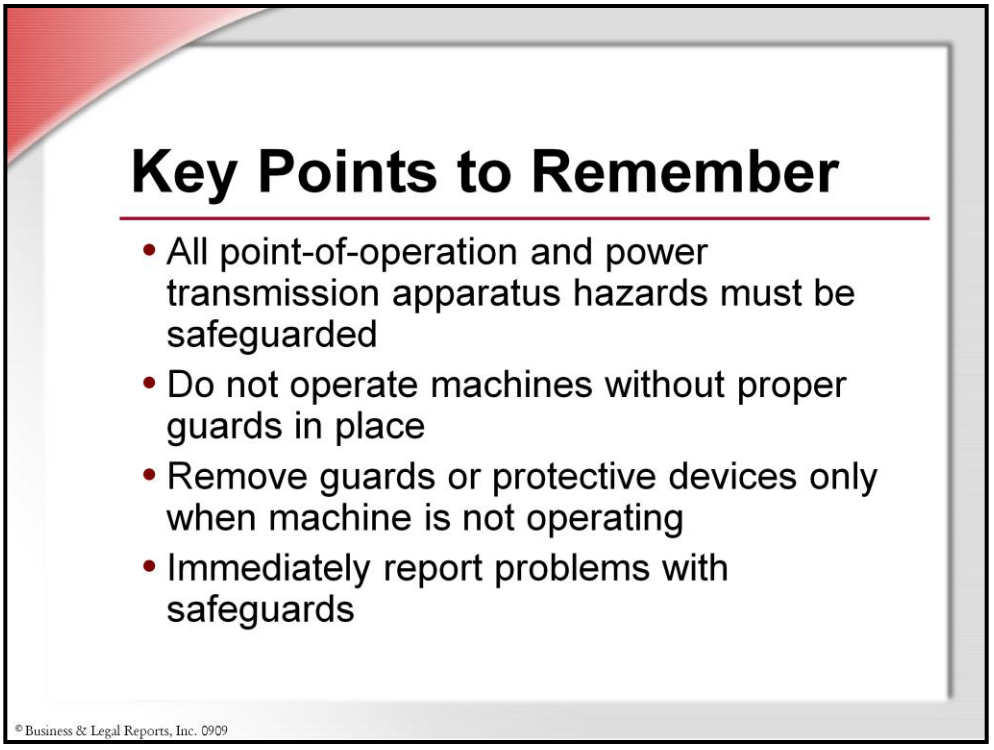
Do you have any questions about the various kinds of machine safeguarding presented in the previous slides?

- Do you understand the "best practices" for machine guarding?
- Are you familiar with the particular types of safeguards?



Slide Show Notes

Here are the key points to remember about machine guarding:

- All hazards of the point of operation and power transmission apparatus must be safeguarded in some way.
- Do not operate machines that do not have their proper guards in place and functioning properly.
- Remove guards and protective devices *only* when the machine is not operating.
- Finally, immediately report any problems with machine guards or protective devices; don't take chances and increase the risk of serious injury.

This concludes the presentation on Machine Guarding.

Now take the test on Machine Guarding for credit.